

REMARKS

Applicants respectfully request reconsideration of the present U.S. Patent application. No claims have been added or canceled. Thus, claims 1, 4-8, 12, 13 and 15-52 are pending.

As a preliminary matter, Applicant submits that the rejections are the result of impermissible hindsight. It is well settled in patent law that there must be something in the prior art as a whole to provide the motivation for, or suggest the desirability of, making the modification suggested by the Examiner. See, for example, Fromson v. Advanced Offset Plate, Inc., 225 U.S.P.Q. 26, 31 (Fed. Cir. 1985). It is well settled that

[i]t is impermissible within the framework of § 103 to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such a reference fairly suggests to one of ordinary skill in the art.

In re Wasselau, 147 U.S.P.Q. 391, 393 (C.C.P.A 1965).

Applicant respectfully contends that the Examiner's combination of so many cited references could only have been accomplished through carefully considered hindsight using Applicant's claims as a reconstructive guide. It is impermissible to use the claimed invention as an instruction manual or "template" to piece together the teachings of the prior art in order to render the claimed invention obvious. In re Fritch, 972 F. 2d 1260, 23 U.S.P.Q. 2d 1780 (Fed. Cir. 1992).

Claims 1, 4-8, 12, 13 and 15-38 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Jerome M. Shapiro "Embedded Image Coding Using Zerotrees of Wavelet Coefficients," IEEE Transactions on Signal Processing, Vol. 41, No. 12, pp. 3445-3462 December 1993 (*Shapiro*) in view of J. W. Woods and S. D. O'Neil, "*Subband coding of images*," IEEE Trans. Acoustics, Speech, and Sig. Proc., vol. 34, pp. 1278-

1288, Oct. 1986 (*Woods*) and U.S. Patent No. 5,455,874 issued to Ormsby, et al. (*Ormsby*) and Pollara, F. and Chen, T. "Rate-Distortion Efficiency of Subband Coding with Integer Coefficient Filters," IEEE International Symposium on Information Theory, pg. 419, June 1994 (*Pollara*) or Applicant's Admitted Prior Art.

Claim 1 recites the following:

applying an overlapped reversible wavelet transform to the input data to produce a series of coefficients, wherein the overlapped reversible wavelet transform is implemented in integer arithmetic such that, with integer coefficients, integer input data is losslessly recoverable; and

compressing the series of coefficients into data representing a compressed version of the input data, including context modeling bits of each of the series of coefficients based on known coefficients in other frequency bands and neighboring coefficients in the same frequency band.

Thus, Applicants claim an overlapped reversible wavelet transform applied to input data.

The reversible transform is implemented in integer arithmetic, such that, with integer coefficients, the input data is losslessly recoverable. Claims 13, 17, 22 and 23 similarly recite an overlapped reversible wavelet transform is implemented in integer arithmetic such that, with integer coefficients, integer input data is losslessly recoverable.

Nothing in *Shapiro* or *Woods* discloses a wavelet transform is implemented in integer arithmetic such that with integer coefficients, integer input data is losslessly recoverable. *Woods* specifically discloses use of real coefficients. For example, *Woods* discloses:

Referring to Fig. 2(a) and the initial four-band splitting, we require that the four subband filters H_{11} through H_{22} have mirror-image conjugate symmetry about their mutual boundaries, which for real h_{ij} is equivalent to ... [equations omitted]

See page 1279, last full paragraph (emphasis added).

The Office Action recites several claim limitations and states that the limitations are not explicitly disclosed by *Shapiro* and suggests that the limitations not explicitly

disclosed by *Shapiro* are inherently disclosed by *Shapiro*. A rejection based on inherency requires that the alleged inherent characteristics must necessarily flow from the reference; **and** that the alleged inherent characteristics would be recognized by one of ordinary skill in the art. See MPEP § 2112, *In re Robertson*, 49 USPQ 2d 1949 (Fed. Cir. 1999), *Continental Can Co. v. Monsanto Co.*, 20 USPQ 2d 1746 (Fed. Cir. 1991), and *SGS-Thompson Microelectronics v. Int'l Rectifier Corp.*, 32 USPQ 2d 1496 (Fed. Cir. 1994). Applicants submit that the rejections based on *Shapiro* fails both elements of the inherency requirement.

For example, the Office Action recites:

It is possible that *Shapiro* also provides for neighboring coefficients in the same frequency band, since he uses anywhere from 2-4 symbols, but [this] is not explicitly taught.

See page 4, lines 4-6 (emphasis added). Applicants submit that the allegation that something is possible does not rise to the level of necessarily flowing from the condition. Therefore, the types of rejections based on *Shapiro* where the limitations are not explicitly taught by *Shapiro*, but the claim limitations could allegedly be derived is not sufficient for an obviousness rejection. Therefore, both *Shapiro* and *Woods* are significantly lacking in disclosing or suggesting the recited elements of the claimed invention.

Claim 1 recites further that the context modeling of bits of coefficients generated by the claimed overlapped reversible wavelet transform is based on known coefficients in other frequency bands and neighboring coefficients in the same frequency band. The Office Action states that *Ormsby* should be combined with *Shapiro* because *Ormsby* improves upon a reference (*Whitten*) cited by *Shapiro*. There must be some supporting teaching in the prior art for the proposed combination of references to be proper. *In re*

Newell, 13 USPQ 2d 1248 (Fed. Cir. 1989). While both *Shapiro* and *Ormsby* cite this common reference, nothing in *Ormsby* explicitly suggests that the teachings of *Whitten* are improved upon. The text of *Ormsby* does not even mention *Whitten*. Therefore, the Office Action fails to suggest a motivation to combine *Ormsby* with *Shapiro*.

The Office Action further combines Applicant's Admitted Prior Art at page 22 of the Specification or *Pollara* with *Shapiro*, *Woods* and *Ormsby* as rendering claims 1, 13, 17, 22 and 23 obvious. Applicant's Admitted Prior Art recites a reversible S-transform. See page 22, lines 8-10. However, the reversible S-transform is not an overlapping transform, which is recited by claims 1, 13, 17, 22 and 23 and allegedly taught by a combination of *Shapiro* and *Woods*. See page 23, lines 9-10. Therefore, combining Applicant's Admitted Prior Art with the teachings of *Shapiro*, *Woods* and *Ormsby* does not result in the method of claims 1, 13, 17, 22 and 23.

Pollara discloses an image compression algorithm that uses quadrature mirror filters with integer coefficients. Specifically, *Pollara* discloses a JPEG-like technique, which is not a losslessly recoverable technique. Therefore, as with *Shapiro* and *Woods* discussed above, *Pollara* does not disclose a wavelet transform implemented in integer arithmetic such that with integer coefficients, integer input data is losslessly recoverable. Therefore, combination of *Shapiro*, *Woods*, *Ormsby* and *Pollara* does not render the method of claims 1, 13, 17, 22 and 23 obvious.

Claims 4-7, 25 and 33 depend from claim 1. Claims 15, 16, 28 and 35 depend from claim 13. Claims 18-21, 29 and 36 depend from claim 17. Claims 30 and 37 depend from claim 22. Claims 24, 31 and 38 depend from claim 23. Because dependent claims include the limitations of the claims from which they depend, Applicants submit that claims 4-7, 15, 16, 18-21, 24, 25, 28-31, 33 and 35-38 are not rendered obvious by

any combination of *Shapiro*, *Woods*, *Ormsby*, *Pollara* and Applicant's Admitted Prior Art for at least the reasons set forth above.

Claim 8 recites the following:

generating a reconstructed version of original data from the plurality of transformed signals with an overlapped inverse reversible wavelet transform, wherein the overlapped inverse reversible wavelet transform is implemented in integer arithmetic such that, with integer coefficients, integer reconstructed original data is losslessly recoverable.

Thus, Applicants claim reconstruction using an inverse reversible wavelet transform implemented using integer arithmetic. Claim 32 similarly recites reconstruction using an inverse reversible wavelet transform implemented using integer arithmetic.

As discussed above, no combination of *Shapiro*, *Woods*, *Ormsby*, *Pollara* and Applicant's Admitted Prior Art teaches or suggests using a reversible wavelet transform implemented using integer arithmetic. Therefore, no combination of *Shapiro*, *Woods*, *Ormsby*, *Pollara* and Applicant's Admitted Prior Art teaches or suggests the inverse operation as claimed in claims 8 and 32.

Claims 26 and 34 depend from claim 8. Because dependent claims include the limitations of the claims from which they depend, Applicants submit that claims 26 and 34 are not rendered obvious by combination of *Shapiro*, *Woods*, *Ormsby*, *Pollara* and Applicant's Admitted Prior Art for at least the reasons set forth above.

Claim 12 recites the following:

generating a first plurality of transformed signals in response to the input data with a reversible overlapped wavelet transform using a pair of non-minimal length reversible filters, implemented in integer arithmetic such that, with integer signals, integer input data is losslessly recoverable; ... and

generating the input data from the second plurality of transformed signals into a reconstructed version of the input data with an inverse reversible overlapped wavelet transform using a second pair of non-minimal length reversible filters.

Thus, Applicants claim both encoding using a reversible overlapped wavelet transform and decoding using an inverse reversible overlapped wavelet transform. Both the encoding and decoding are implemented in integer arithmetic such that with integer signals, integer input data is losslessly recoverable.

As discussed above, no combination of *Shapiro*, *Woods*, *Ormsby*, *Pollara* and Applicant's Admitted Prior Art teaches or suggests using a reversible wavelet transform implemented using integer arithmetic or the inverse operation. Therefore, no combination of *Shapiro*, *Woods*, *Ormsby*, *Pollara* and Applicant's Admitted Prior Art teaches or suggests the invention as claimed in claim 12.

Claim 27 depends from claim 12. Because dependent claims include the limitations of the claims from which they depend, Applicants submit that claim 27 is not rendered obvious by combination of *Shapiro*, *Woods*, *Ormsby*, *Pollara* and Applicant's Admitted Prior Art for at least the reasons set forth above.

Claims 44-50 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Shapiro* in view of *Woods*, *Ormsby* and *Pollara* or Applicant's Admitted Prior Art in further view of U.S. Patent No. 5,495,292 issued to Zhang, et al. (*Zhang*). For at least the reasons set forth below, Applicants submit that claims 44-50 are not rendered obvious by any combination of *Shapiro*, *Woods*, *Ormsby*, *Pollara*, Applicant's Admitted Prior Art and *Zhang*.

Claims 44-50 each depend from one of the independent claims discussed above and generally recite that the determinant of the overlapped reversible wavelet transform is equal to 1. *Shapiro* recites:

...using properly scaled coefficients, the transformation matrix for a discrete wavelet transform obtained using these filters is so close to unitary that it can be treated as unitary for the purpose of lossy compression.

See page 3448, first full paragraph, left column (emphasis added). Thus, even if *Shapiro* suggests use of a transform with a determinant of 1, that is for lossy compression, not for lossless compression as recited in the independent claims. Therefore, in addition to the shortcomings discussed above, *Shapiro* does not teach or suggest the limitations of claims 44-50.

The Office Action also rejects claims 44-50 as being rendered obvious by combination of *Shapiro*, *Woods*, *Ormsby*, *Pollara*, Applicant's Admitted Prior Art and *Zhang*. *Zhang* is cited to teach use of a transform with a determinant of 1. A determinant is a square array of numbers having a numerical value, Δ , that is a difference of products of numbers within the array. As a 2x2 example the determinant of

$$\begin{vmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{vmatrix}$$

is $a_{11}a_{22} - a_{12}a_{21}$.

Zhang does not mention the evaluation of a determinant, nor does *Zhang* include an array from which a determinant can be inferred. Therefore, *Zhang* in combination with *Shapiro*, *Woods*, *Ormsby*, *Pollara*, Applicant's Admitted Prior Art fails to render claims 44-50 obvious.

Claims 39, 40 and 42 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Shapiro* in view of *Woods* and *Pollara* or Applicant's Admitted Prior Art. For at least the reasons set forth below, Applicants submit that claims 39, 40 and 42 are not rendered obvious by any combination of *Shapiro*, *Woods*, *Pollara* and Applicant's Admitted Prior Art.

The reversible Two/Ten wavelet transform recited in claims 39, 40 and 42 are not disclosed or suggested in any of *Shapiro*, *Woods*, *Pollara* and Applicant's Admitted Prior

Art. Moreover, the reversible Two/Ten wavelet transform is not considered a filter that is conventional. Therefore, Applicants submit that no combination of *Shapiro*, *Woods*, *Pollara* and Applicant's Admitted Prior Art teaches or suggests the invention as claimed in claims 39, 40 and 42.

Claims 41 and 43 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Shapiro* in view of *Woods* and *Pollara* or Applicant's Admitted Prior Art and further in view of *Ormsby*. For at least the reasons set forth below, Applicants submit that claims 41 and 43 are not rendered obvious by any combination of *Shapiro*, *Woods*, *Pollara*, Applicant's Admitted Prior Art and *Ormsby*.

Claims 51 and 52 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Shapiro* in view of *Woods* and *Pollara* or Applicant's Admitted Prior Art in further view of *Zhang*. For at least the reasons set forth below, Applicants submit that claims 51 and 52 are not rendered obvious by any combination of *Shapiro*, *Woods*, *Pollara*, Applicant's Admitted Prior Art and *Zhang*.

Claims 51 and 52 depend from claims 39 and 42, respectively, which are discussed above. Both claims 51 and 52 recite that the determinant of the reversible transform is equal to 1. As discussed above neither *Shapiro* nor *Zhang* teach or suggest that the determinant of a transform should be 1 for lossless encoding. Therefore, no combination of *Shapiro*, *Woods*, *Pollara*, Applicant's Admitted Prior Art and *Zhang* teaches or suggests the invention as claimed in claims 51 and 52.

Claims 25-31 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Shapiro* in view of *Woods*, *Ormsby* and *Pollara* or Applicant's Admitted Prior Art and further in view of U.S. Patent No. 5,481,308 issued to Hartung, et al. (*Hartung*) or Japanese Patent No. JP406038193A issued to Shinichi (*Shinichi*). For at least the reasons

set forth below, Applicants submit that claims 25-31 are not rendered obvious by any combination of *Shapiro*, *Woods*, *Pollara*, Applicant's Admitted Prior Art and *Hartung* or *Shinichi*.

Applicants submits that neither *Hartung* nor *Shinichi* teaches or suggests a reversible Two/Ten transform. Therefore, Applicants submit that no combination of *Shapiro*, *Woods*, *Pollara*, Applicant's Admitted Prior Art and *Hartung* or *Shinichi* teaches or suggests the invention as claimed in claims 25-31.

For at least the foregoing reasons, Applicants submit that the rejections under 35 U.S.C. § 103(a) have been overcome. Therefore, claims 1, 4-8, 12, 13 and 15-52 are in condition for allowance and such action is earnestly solicited. The Examiner is respectfully requested to contact the undersigned by telephone if such contact would further the examination of the present application.

Please charge any shortages and credit any overcharges to our Deposit Account number 02-2666.

Respectfully submitted,
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MARKED VERSION OF THE AMENDED CLAIMS

1. (Six Times Amended) A method for encoding input data comprising:
applying an overlapped reversible wavelet transform to the input data to produce a series of coefficients, wherein the overlapped reversible wavelet transform is implemented in integer arithmetic such that, with integer coefficients, integer input data is losslessly recoverable; and

compressing the series of coefficients into data representing a compressed version of the input data, including context modeling bits of each of the series of coefficients based on known coefficients in other frequency bands and neighboring coefficients in the same frequency band.

8. (Five Times Amended) A method for decoding data into original data comprising:

decompressing a compressed version of input data into a plurality of transformed signals, including context modeling bits of the plurality of transformed signals based on known transformed signals in other frequency bands and neighboring transformed signals in the same frequency band; and

generating a reconstructed version of original data from the plurality of transformed signals with an overlapped inverse reversible wavelet transform, wherein the overlapped inverse reversible wavelet transform is implemented in integer arithmetic such that, [data] with integer coefficients, integer reconstructed original data is losslessly recoverable.

12. (Five Times Amended) A method for processing input data comprising:

generating a first plurality of transformed signals in response to the input data with a reversible overlapped wavelet transform using a pair of non-minimal length reversible filters, implemented in integer arithmetic such that, with integer signals, integer input data is losslessly recoverable;

compressing the first plurality of transformed signals into data representing a compressed version of the input data, including context modeling the first plurality of transformed signals based on known transformed signals in other frequency bands and neighboring transformed signals in the same frequency band;

decompressing the compresses version of the input data into a second plurality of transformed signals; and

generating the input data from the second plurality of transformed signals into a reconstructed version of the input data with an inverse reversible overlapped wavelet transform using a second pair of non-minimal length reversible filters.

13. (Five Times Amended) A method for encoding input data comprising:
transform encoding the input data into a series of coefficients with an overlapped reversible wavelet transform, wherein the overlapped reversible wavelet transform is implemented in integer arithmetic such that, with integer coefficients, integer input data is losslessly recoverable; and

embedded coding the series of coefficients, including [the steps of] ordering the series of coefficients, performing bit significance embedding on the series of coefficients, wherein a first type of embedded coding is performed on a first portion of the data and a second type of embedded coding is performed on a second portion of data using context

modeling based upon known coefficients in other frequency bands and neighboring coefficients in the same frequency band.

17. (Five Times Amended) A method for encoding input data comprising:

transforming input data into a series of coefficients with an overlapped reversible wavelet transform, wherein the overlapped reversible wavelet transform is implemented in integer arithmetic such that, with integer coefficients, integer input data is losslessly recoverable;

converting the series of coefficients into sign-magnitude format to produce a series of formatted coefficients;

coding a first portion of the series of coefficients using a first type of embedded coding to produce a first bit stream;

coding a second portion of the series of formatted coefficients using a second type of embedded coding that models data using known coefficients in other frequency bands and neighboring coefficients in the same frequency to produce a second bit stream; and

coding the first bit stream and second bit stream into a single bit stream.

22. (Twice Amended) An encoder for encoding input data into a compressed data stream, said [entropy coder] encoder comprising:

a reversible wavelet filter to transform [for transforming] the input into a plurality of coefficients, wherein the reversible wavelet filter is implemented in integer arithmetic such that, with integer coefficients, integer input data is losslessly recoverable;

an embedded coder coupled to the reversible wavelet filter to perform [for performing] embedded coding on the plurality of coefficients to generate a bit stream, when the embedded coder comprises a context model to model data based on known coefficients in other frequency bands and neighboring coefficients in the same frequency band; and

an entropy coder coupled to the embedded coder to perform entropy coding on the bit stream to create coded data.

23. (Twice Amended) An encoder for encoding input data comprising:
a transform coder coupled to receive the input data and generate a series of coefficients to represent a decomposition of the input data using an overlapped reversible wavelet transform, wherein the overlapped reversible wavelet transform is implemented in integer arithmetic such that, with integer coefficients, integer input data is losslessly recoverable; and

an embedded coder coupled to receive the series of coefficients and perform bit-significance encoding on the series of coefficients to create coded data, when the embedded coder comprises a context model to model data based on known coefficients in other frequency bands and neighboring coefficients in the same frequency band, the embedded coder producing the coded data as the series of coefficients are received.

32. (Twice Amended) A decoder for decoding input data comprising:
a decompressor to decompress a compressed version of input data into a plurality of coefficients using context modeling based on known coefficients in other frequency bands and neighboring coefficients in the same frequency band; and

an overlapped inverse reversible wavelet transform coupled to the decompressor to generate a reconstructed version of original data from the plurality of coefficients, wherein the overlapped inverse reversible wavelet transform is implemented in integer arithmetic such that, [data] with integer coefficients, integer reconstructed original data is losslessly recoverable.